

[Translation]



P2003-10394

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Application Number : Patent Application No. 2003-10394

Date of Application : Feb 19, 2003

Applicant(s) : LG Electronics Inc.

COMMISSIONER

[ABSTRACT OF THE DISCLOSURE]**[ABSTRACT]**

The present invention relates to an organic electroluminescent device having a substrate including an anode layer, a hole injection layer, a hole transport layer, an organic luminescent layer, a hole blocking layer, an electron transport layer and a cathode layer serially formed thereon to embody a multi color and full color device, and the blue luminescent layer may be formed of the fluorescent substance and the green and red luminescent layers may be formed of the phosphorescent substance, or the blue luminescent layer may be formed of the fluorescent substance and the green or red luminescent layer may be formed of the phosphorescent substance, and the hole blocking layer may be formed of the same substance(s) as that of the blue luminescent layer on the luminescent layer(s).

[TYPICAL DRAWING]

FIG. 2

[INDEX WORDS]

hole blocking layer, blue luminescent layer,

fluorescent, phosphorescent, blocking substance

[SPECIFICATION]

[TITLE OF THE INVENTION]

ORGANIC ELECTROLUMINESCENT DEVICE

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 is a manufacturing diagram of a related art organic electroluminescent device.

FIG. 2 is a manufacturing diagram of an organic electroluminescent device according to the present invention.

FIG. 3 is a diagram of an organic electroluminescent device fabricated according to the present invention.

Reference numerals of the essential parts in the drawings

- 11 : ITO substrate
- 12 : anode layer
- 13 : hole injection layer
- 14 : hole transport layer
- 15 : organic luminescent layer
- 16 : hole blocking layer
- 17 : electron transport layer

18 : cathode layer

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]

The present invention relates to an organic electroluminescent device, and more particularly, to an organic electroluminescent device having high brightness.

With the development of telecommunication technology, as demand for information society becomes diversified, demand for electric display has been increased and request for display becomes various. To satisfy this diversified demand of information society, the electric display device is required to be scale-up, low-priced, scouped-up, thin, scale-down, etc. For this, new flat panel display device is being developed addition to the conventional cathode ray tube.

Recently developed or manufactured flat panel displays are a liquid crystal display, en electroluminescent display, and a plasma display panel, a field emission display, a vacuum fluorescence display, and a light emitting display.

The electroluminescent display has a rapid respond speed compare to light receiving displays such as a liquid

crystal display. The electroluminescent display has a wide viewing angle since it is luminescent itself and easy to be manufactured since it has a simple structure. Moreover, the electroluminescent display is light weight and thin. Therefore, the electroluminescent display is considered as the next generation flat display device. The electroluminescent display can be used for various uses such as back light of the liquid crystal display, portable terminal, car navigation system, laptop computer, and wall mounted TV.

The electroluminescence display is divided into an organic electroluminescent display (Hereinafter, referred to as 'OELD') and an inorganic electroluminescent display according to a kind of substances used for electroluminescent layer. The inorganic electroluminescent display is a device radiating by using collision of electrons accelerated by high electric field. The inorganic electroluminescent display is divided into an alternating current thin-film electroluminescent display, an alternating current thick-film electroluminescent display, and direct current thick-film electroluminescent display according to a thickness of a thin film and operating method. The organic electroluminescent display is a device radiating by a flow of electricity. The

organic electroluminescent display divided into a low molecular organic electroluminescent display and a high molecular organic electroluminescent display according to an organic substance of a luminescent layer.

FIG. 1 illustrates a diagram showing a fabricating process of a related-art organic electroluminescent full color device.

Referring to FIG. 1, the organic electroluminescent display device forms a transparent anode layer, a hole injection layer, and a hole transport layer on a transparent substrate and covers a red phosphorescent layer and a hole blocking layer with a mask.

Then, with the same method, the organic electroluminescent display forms a green phosphorescent layer and a hole blocking layer, and a blue luminescent layer.

Then, a full color device is formed by depositing an electron transport layer and an electron injection layer electrode.

The organic electroluminescent display device as constituted above is, as stated in U.S. Patent No. 6, 097, 147, phosphorescent emitting material such as platinum 2,3,7,8,12,12,17,18-octaethyl-21H,23H-porphine platinum and Iridium complex and a phosphorescent OLED device using

a blocking layer such as Bathocuproine between a luminescent layer (14) and an electron transport layer (16).

However, such related-art organic electroluminescence display has a disadvantage that the blocking layer should be deposited additionally two times in manufacturing, thereby lengthening time for manufacturing the device.

[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]

Accordingly, the present invention is directed to an organic electroluminescent display device substantially obviates one or more problems due to limitations and disadvantages of the related art.

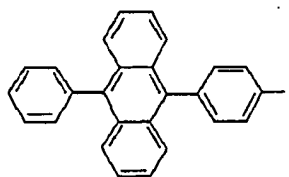
An object of the present invention is to provide an organic electroluminescent multi color or full color device by using easier method, thereby simplifying the manufacturing process.

[SYSTEM AND OPERATION OF THE INVENTION]

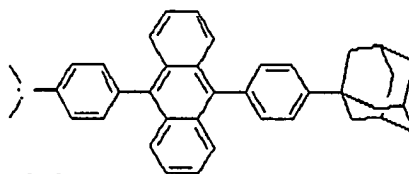
To achieve these objects, the organic electroluminescent device according to the present invention has a substrate having an anode layer, a hole injection layer, a hole transport layer, an organic

luminescent layer, a hole blocking layer, an electron transport layer and a cathode layer serially formed thereon to embody a multi color and full color device and the blue luminescent layer may be formed of the fluorescent substance and the green and red luminescent layers may be formed of the phosphorescent substance, or the blue luminescent layer may be formed of the fluorescent substance and the green or red luminescent layer may be formed of the phosphorescent substance, and the hole blocking layer may be formed of the same substance as that of the blue luminescent layer on the luminescent layer(s) or the hole blocking layer can be formed of any one of substance if the blue luminescent layer is comprised of a plurality of substances.

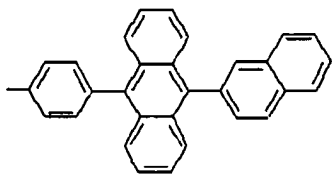
The following substance can be used for forming the blue luminescent layer or the hole blocking layer.



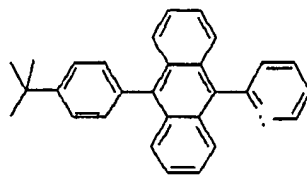
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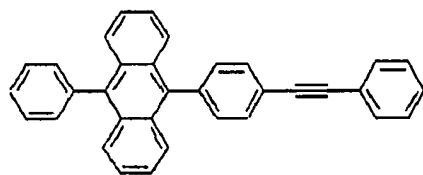
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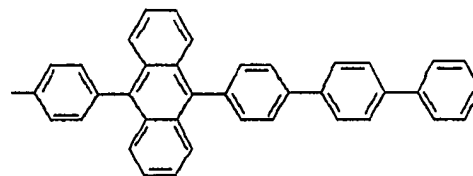
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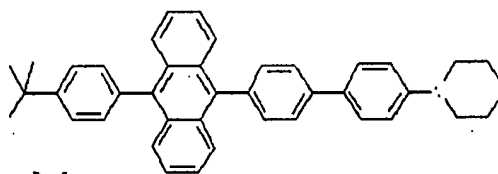
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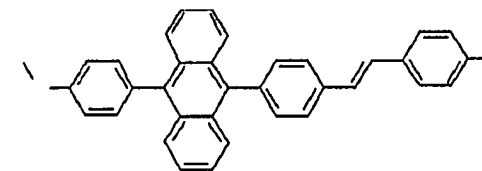
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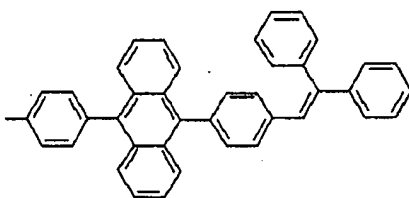
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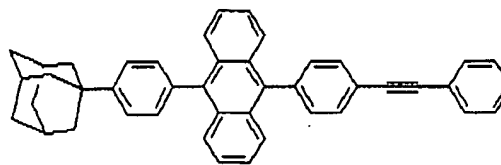
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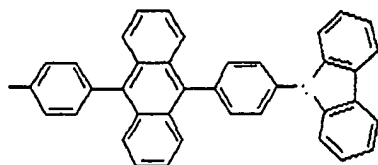
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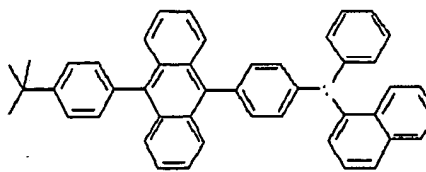
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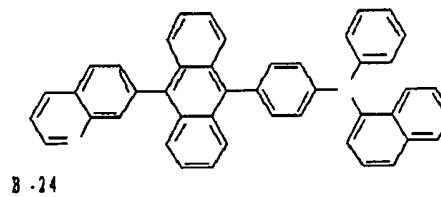
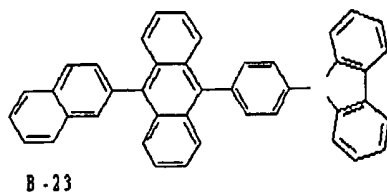
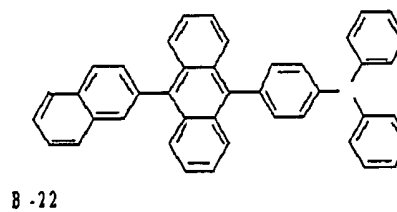
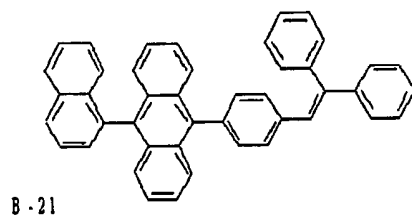
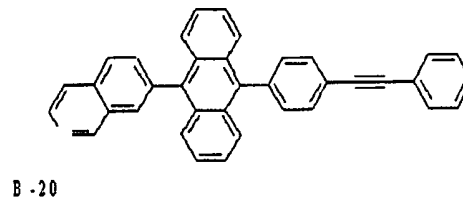
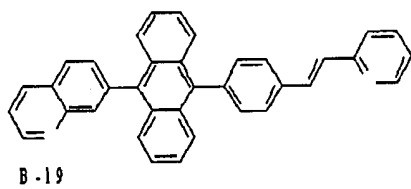
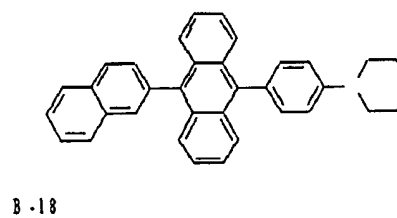
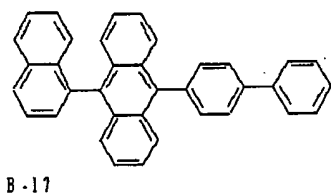
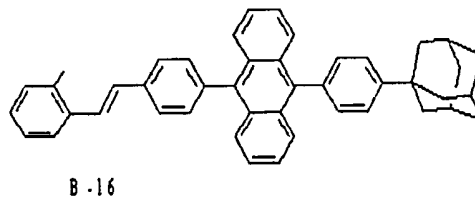
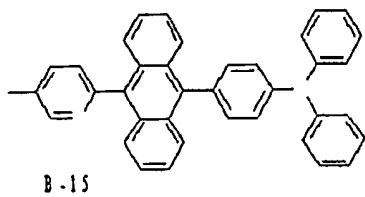
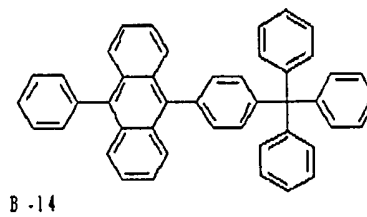
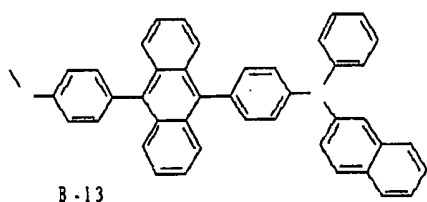
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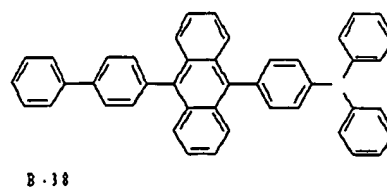
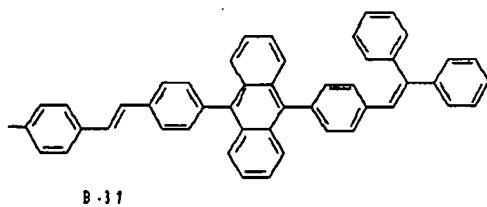
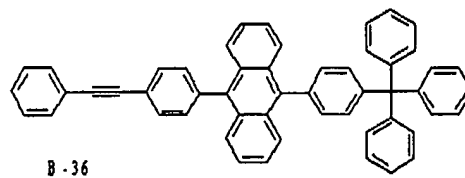
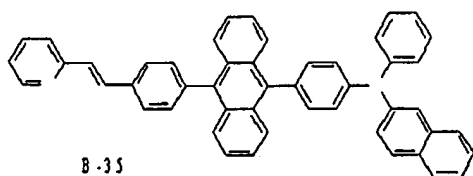
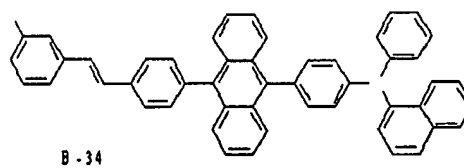
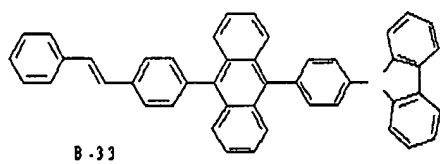
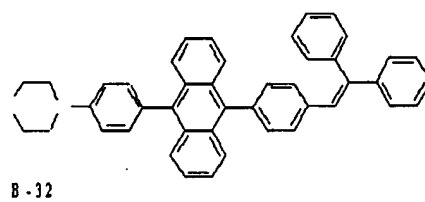
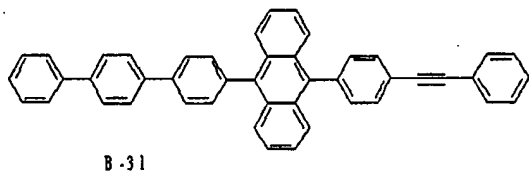
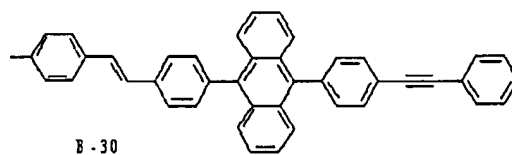
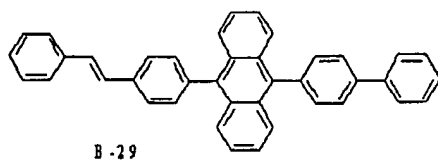
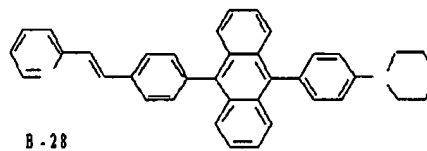
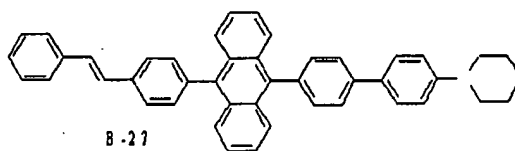
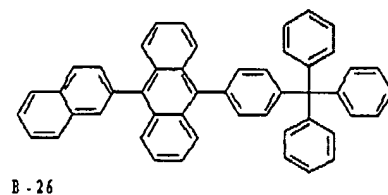
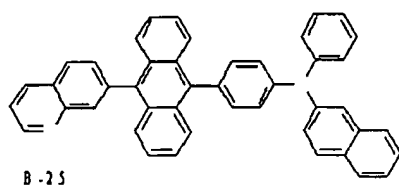


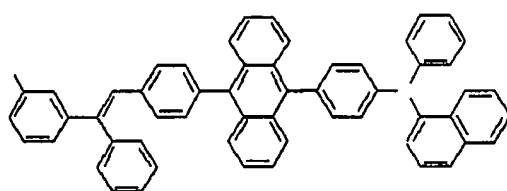
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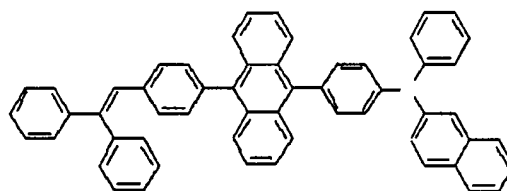
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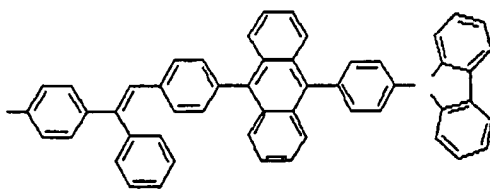




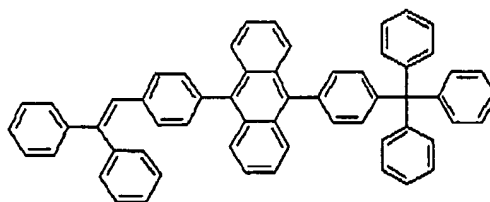
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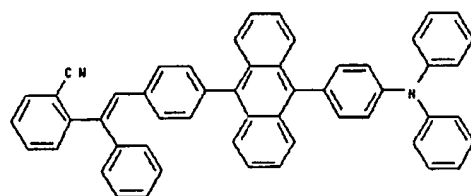
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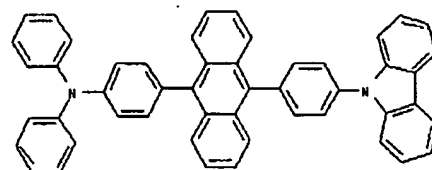
B-47



B-48



B-49



B-50



Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

A preferred embodiment of the organic electroluminescent device according to the present invention will be described in the following with reference to the attached drawings.

Referring to FIG. 2, the organic electroluminescent display device forms a transparent anode layer, a hole injection layer, and a hole transport layer on a

transparent substrate and covers a red phosphorescent layer with a mask.

Then, with the same method, the organic electroluminescent display forms a green phosphorescent layer, and a blue luminescent layer.

After removing the mask, the full color device is manufactured by depositing a hole blocking layer, an electron transport layer, an electron injection layer, and an electrode.

Accordingly, since the frequency for depositing the hole blocking layer can be reduced to one time, the manufacturing process becomes greatly simple.

An experiment is executed to confirm the characteristics of the organic electroluminescent device as follows.

First of all, an ITO glass is patterned so as to have a size of 2mm x 2mm. The patterned ITO glass is then cleaned. The substrate is loaded on a vacuum chamber of which basic pressure is set up as 1×10^{-6} torr and organic matters are deposited on the ITO substrate in order.

At this time, in the present invention, B-48 is used as the blue luminescent layer and hole blocking layer.

Accordingly, in a case of green, CuPC(200Å) for a hole injection layer, NPD(400Å) for a hole transport layer,

CBP+Irppy3(8%)(200Å) for an organic luminescent layer, B-48(100Å) for a hole blocking layer, Alq3(300Å) for an electron transport layer, LiF(5Å) for an electron injection layer, and Al(1000Å) for a cathode layer are deposited sequentially to make a luminescent device.

And, in a case of red, the structure is same as above green case, but CBP+(btp)2Ir(acac)(8%)(200Å) is used for a luminescent layer.

Further, in a case of blue, the structure is same as above case, but CBP+B-48(15%)(200Å) is used for a luminescent layer.

The characteristic of the device is described as follows.

	Green	Red	Blue
Brightness (A10mA/cm2)	2494	559	240
CIE (x,y)	(0.32 0.61)	(0.66 0.32)	(0.16 0.16)

[EFFECT OF THE INVENTION]

As described above, an organic electroluminescent device according to the present invention has following advantages.

First, an organic electroluminescent device having high brightness and long life can be provided.

Second, by forming the hole blocking layer with the same substance as that of the blue luminescent layer, the fabrication process is simplified, thereby improving productivity and reducing the fabrication cost and the cost of the organic electroluminescent device.

It will be apparent to those skilled in the art than various modifications and variations can be made in the present invention.

Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is :

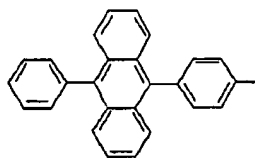
1. The organic electroluminescent device having a substrate having an anode layer, a hole injection layer, a hole transport layer, an organic luminescent layer, a hole blocking layer, an electron transport layer and a cathode layer serially formed thereon to embody a multi color and full color device, and the blue luminescent layer may be formed of the fluorescent substance and the green and red luminescent layers may be formed of the phosphorescent substance, or the blue luminescent layer may be formed of the fluorescent substance and the green or red luminescent layer may be formed of the phosphorescent substance, and

the hole blocking layer may be formed of the same substance(s) as that of the blue luminescent layer on the luminescent layer(s)

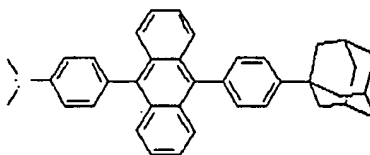
2. The organic electroluminescent device as claimed in claim 1, wherein the hole blocking layer can be formed of any one of substance if the blue luminescent layer is comprised of a plurality of substances.

3. The organic electroluminescent device as claimed in claim 1, wherein the following substance can be used for forming the blue luminescent layer or the hole

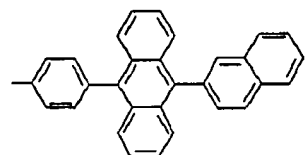
blocking layer.



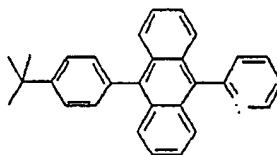
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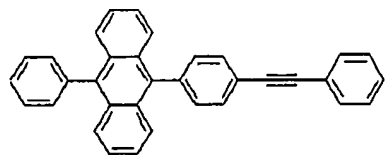
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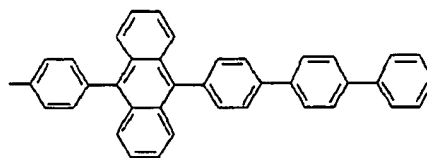
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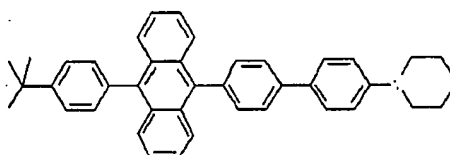
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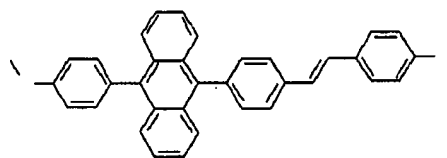
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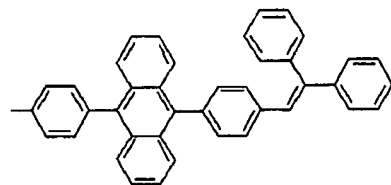
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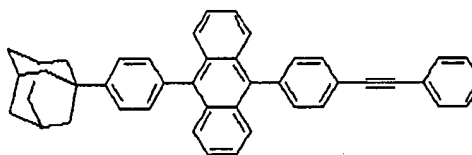
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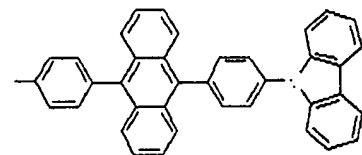
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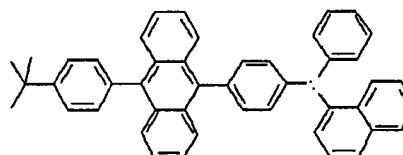
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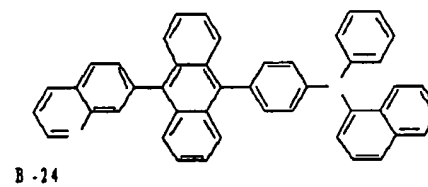
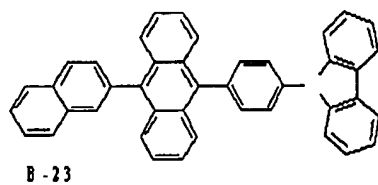
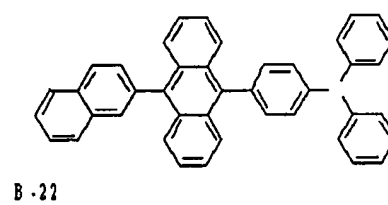
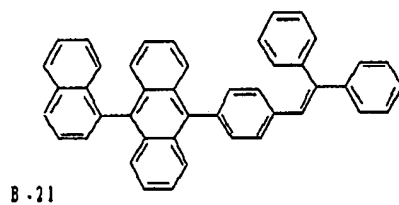
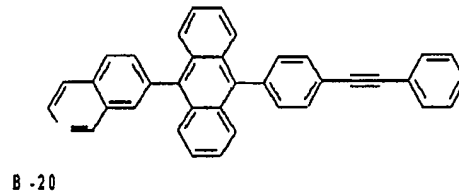
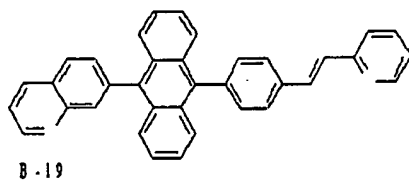
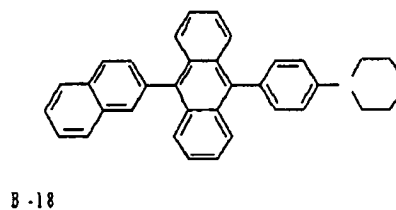
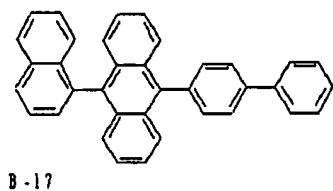
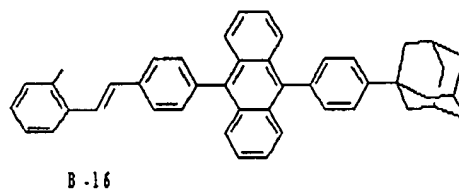
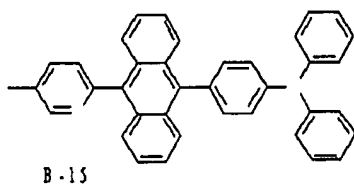
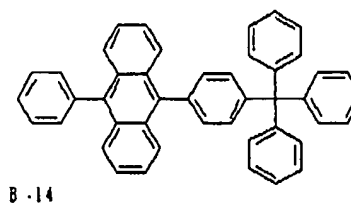
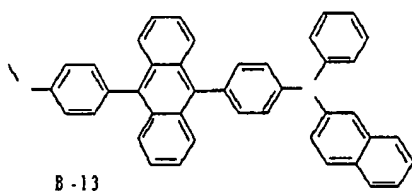
B-10

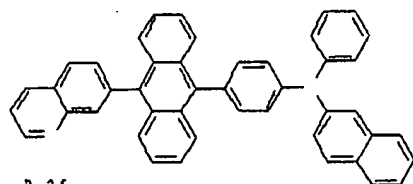


B-11

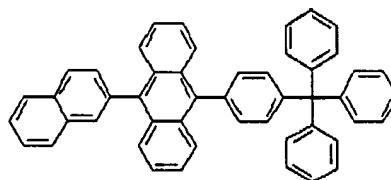


B-12

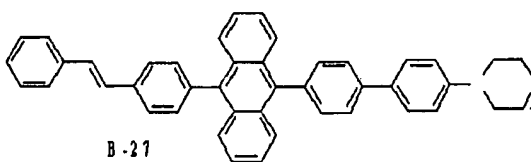




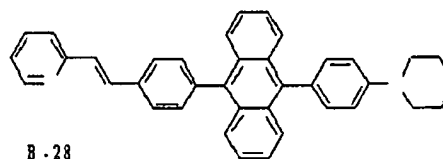
B-25



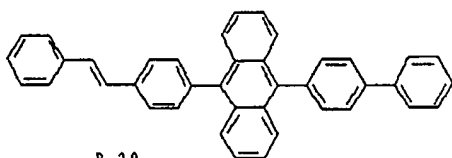
B-26



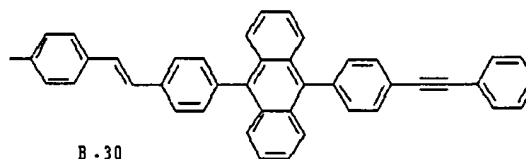
B-27



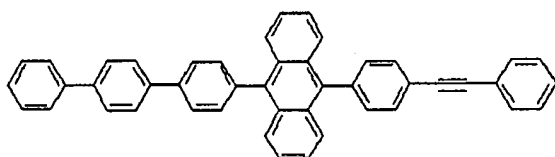
B-28



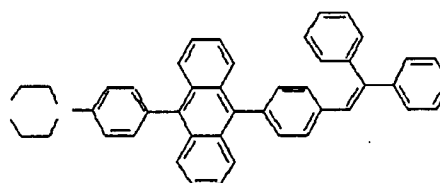
B-29



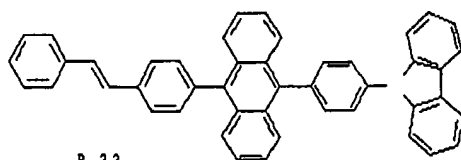
B-30



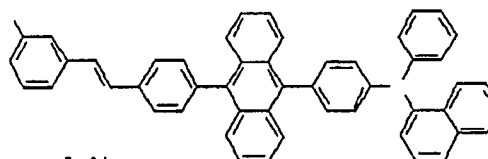
B-31



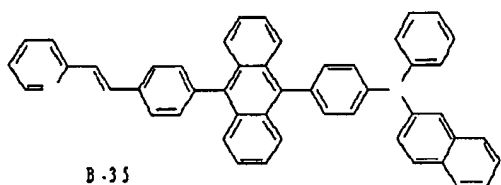
B-32



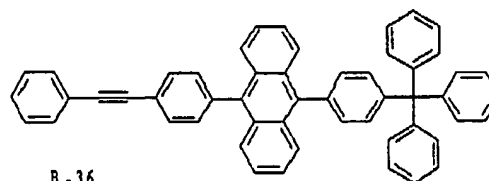
B-33



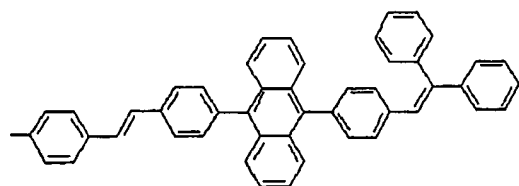
B-34



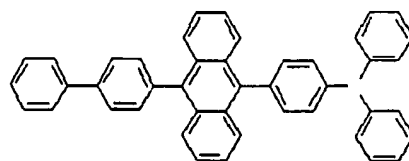
B-35



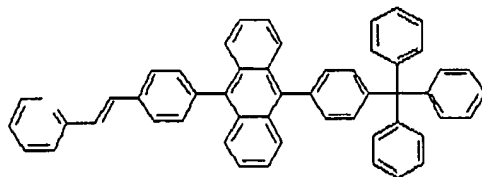
B-36



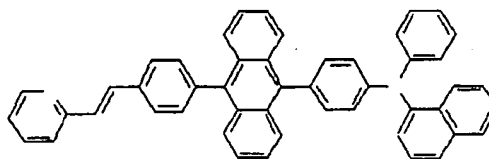
B-37



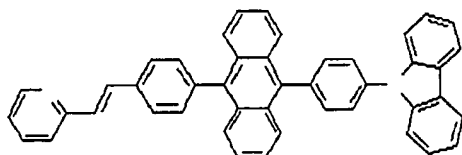
B-38



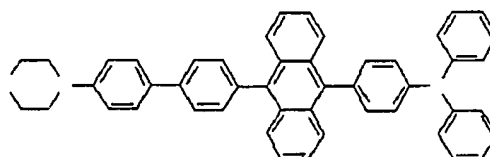
B-39



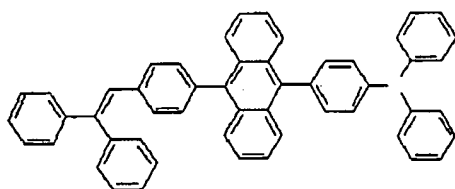
B-40



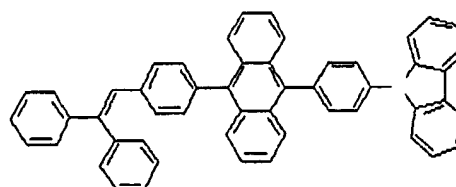
B-41



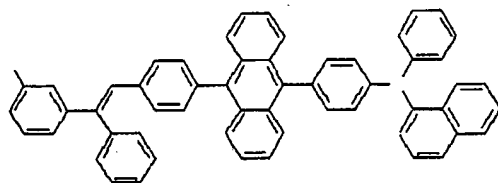
B-42



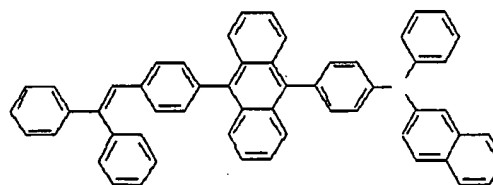
B-43



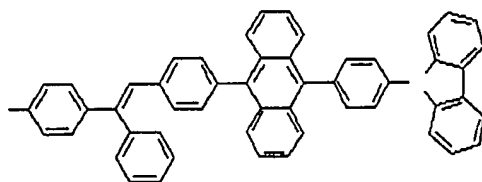
B-44



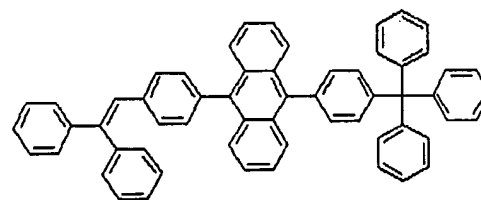
B-45



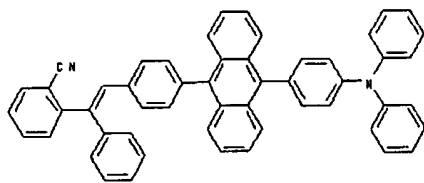
B-46



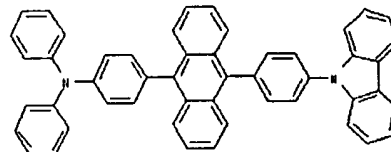
B-47



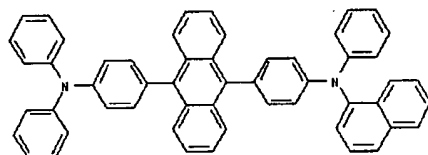
B-48



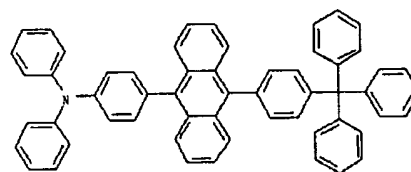
B - 49



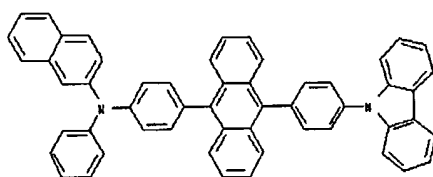
B - 50



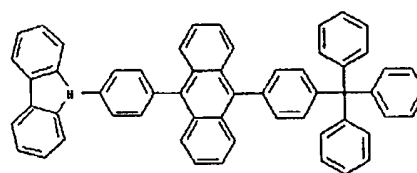
B - 51



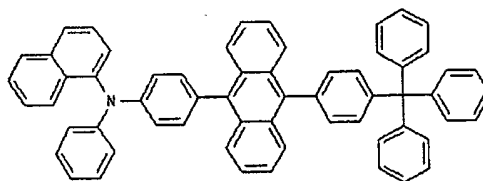
B - 52



B - 53



B - 54



B - 55

FIG. 1

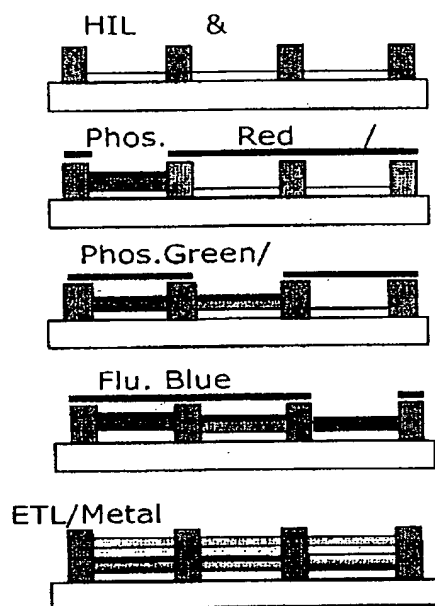


FIG. 2

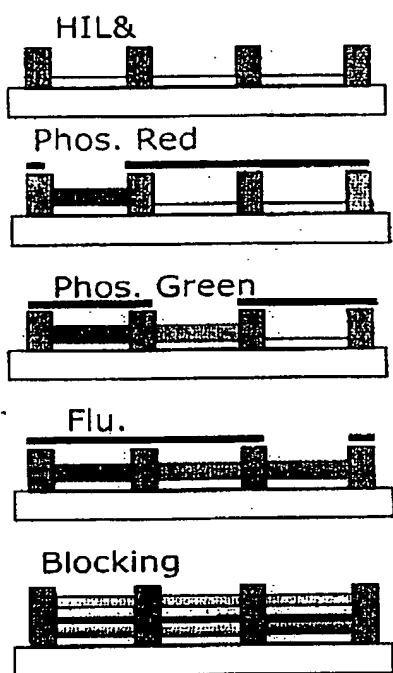


FIG. 3

